

WHAT IS CLAIMED IS:

1. A plasma processing method for performing film formation, etching, surface treatment or the like on a substrate by supplying high frequency power between an electrode and a holder, by which the substrate is supported to be opposed to the electrode, to generate plasma between the electrode and the substrate on the basis of a plasma processing gas,

wherein pressure  $P(\text{Torr})$  of the plasma processing gas is set to satisfy the following relationship

$$2 \times 10^{-7} (\text{Torr}/\text{Hz}) \times f(\text{Hz}) \leq P(\text{Torr}) \leq 500 (\text{Torr})$$

where  $f(\text{Hz})$  is a frequency of the high frequency power.

2. The plasma processing method according to claim 1, wherein the plasma processing gas is a mixture gas of a reactant gas and an inert gas.

3. The plasma processing method according to claim 1, wherein the pressure  $P(\text{Torr})$  of the plasma processing gas is set to a pressure near a lower limit of a range which is within a range described in claim 1 and, in which the plasma can be maintained stable.

4. The plasma processing method according to claim 2, wherein the pressure  $P(\text{Torr})$  of the plasma processing gas is set to satisfy the following relationship

$$5 \times P_r(\text{Torr}) \leq P(\text{Torr})$$

where  $P_r(\text{Torr})$  is partial pressure of the reactant gas.

5. The plasma processing method according to claim 2, wherein the pressure  $P(\text{Torr})$  of the plasma processing gas is set to satisfy the

following relationship

$$P(\text{Torr}) \leq 3.5 \times P_L(\text{Torr})$$

where the pressure  $P_L(\text{Torr})$  is a higher one of a pressure represented by a relationship

5  $P_L(\text{Torr}) = 5 \times P_r(\text{Torr})$

and a pressure represented by a relationship

C'  $P_L(\text{Torr}) = 2 \times 10^{-7} (\text{Torr/Hz}) \times f(\text{Hz})$

where  $f(\text{Hz})$  is a frequency of the high frequency power and  $P_r(\text{Torr})$  is a partial pressure of the reactant gas.

10 6. The plasma processing method according to claim 1, wherein the frequency  $f(\text{Hz})$  of the high frequency power is at least 10MHz and at most 500MHz, and the pressure  $P(\text{Torr})$  of the plasma processing gas is at least 100Torr and at most 500Torr.

15 7. The plasma processing method according to claim 2, wherein the inert gas is a He gas.

8. The plasma processing method according to one of claims 1 to 7, wherein the plasma processing method is one for performing film forming processing on a substrate.

20